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31 August 1964

MEMORANDUM FOR: Director of Central Intelligence

THROUGH : Deputy Director of Central Intelligence

SUBJECT : Conduct of the FULCRUM Program

REFERENCE : a. DDCI Memorandum to DD/S&T, 27 Aug. 1964
b. DCI Memorandum to DD/S&T, 14 Aug. 1964

1. Purpose - The following basic paper has been prepared in response to recent guidelines (Ref. a.) and (Ref. b.) for the conduct of the FULCRUM Satellite Reconnaissance Program by CIA under NRO aegis. It confirms the terms of reference you have established and advances a specific management plan for Phase I FULCRUM development for your approval.

2. Background - The FULCRUM concept grew out of CIA/DD/S&T in-house studies and a small CIA funded [redacted] effort at ITEK, designed to explore the potential improvement of broad area, general search photographic satellite reconnaissance systems. These studies were conducted primarily during the second half of fiscal year 1964. During May of 1964 a specific system proposal was put forward for realizing remarkable resolution improvement over the present search system (CORONA) while retaining its broad area coverage feature. The basic concept is to exploit the TITAN II booster to place a 5,500 pound photographic payload directly into low earth orbit without the use of additional rocket stages. The payload would consist of two rotating 60 inch focal cameras to give stereo coverage at a nadir ground resolution of 2 to 4 feet across a strip 360 miles wide. The spacecraft would carry enough film (68,000 ft. of 7 inch EK type 4404) to photograph approximately eleven million square miles each mission, at a cost of approximately [redacted] per launch. A new re-entry vehicle must be developed to return this enormous amount of film.

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This concept was examined critically in June 1964 by a non-government committee under Dr. Edwin Land, who reported that the concept held real promise. He recommended that it should be vigorously explored as to its detailed technical reliability in a Phase I effort during the first half of FY 1965. He and his Panel identified four specific areas that must be demonstrated or analyzed in enough depth to support an all out development and flight program:

a. Feasibility of moving the film rapidly and accurately through the cameras.

b. Stability and noise of the rotating camera bearing system.

c. Compatibility of the all-up payload weight (i.e., cameras, film, re-entry vehicle, spacecraft) with the lifting capability of the TITAN II booster.

d. Composition, coupling, and control of the several components of angular momentum associated with the rotating camera and the high speed film supply.

Dr. Land urged the DCI to move ahead rapidly in exploring these problems in a Phase I feasibility effort.

Subsequent conversations between Mr. Vance and the Director have established FULCRUM as a proper part of the National Reconnaissance Program, to be conducted by the CIA under NRO aegis. They have directed that the TITAN III be considered as a backup to the TITAN II, and that its additional payload capability be explored to see how the FULCRUM concept might be enhanced thereby. With NRO concurrence, CIA made [redacted] of FY 1964 year-end money available to start the program.

3. Terms of Reference - Reference b. delineates guidelines for the conduct of the Phase I FULCRUM program and was coordinated with Mr. Vance. This guidance was as follows:

a. There shall be no commitment made to the contractors to proceed past the Phase I feasibility effort.

b. CIA is to employ contractors and engineers to the fullest possible extent, avoiding unnecessary expansion of the DD/S&T staff.

c. CIA is to reserve as an "in-house" responsibility the supervision and guidance of the contractors and engineers.

d. Employment of a systems engineering contractor responsible for: (i) developing plans, specifications, etc., for all phases of the project on an integrated basis, and (ii) performing such other functions as DD/S&T may direct. The systems engineer could, under DD/S&T direction, assume a coordinating and supervision function, but should not act as a prime contractor for the other contract efforts. The selection of this contractor need not be made competitively.

e. Competitive contracts with two or more contractors to study and demonstrate the film transport mechanism.

f. Contract for camera design and feasibility demonstration, which probably should go to ITEK because of their own input to the basic FULCRUM concept.

g. Competitive selection of a spacecraft design study contractor.

h. Subsequent instructions included competitive selection of a re-entry vehicle design study contractor.

4. Reference a. provides that:

a. Command, control, supervision and direction of the entire FULCRUM Phase I program is assigned to DD/S&T.

b. Coordination, liaison, project integration and engineering support will be provided to DD/S&T by the systems engineering contractor, who will have direct access to all other contractors.

c. DD/S&T will keep NRO fully and completely informed of its progress through regular monthly progress reports and/or briefings, and will provide information copies of contractor work statements to NRO.

d. DD/S&T will act as the sole point of contact and direction in the government for the FULCRUM contractors.

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e. Additional funds up to [redacted] may be committed against the DD/S&T plan, as approved by the DDCI. As in any such program, the contractors will be reimbursed by CIA as the work progresses, subject to the satisfaction of the CIA as to its quality. The NRO will reimburse the CIA for funds expended in the FULCRUM program in accordance with previous agreements between Mr. Vance and the Director.

f. A specific unit will be established in DD/S&T reporting directly to the DD/S&T to manage the FULCRUM and other satellite programs. In consonance with the Director's discussions with the PFIAB and Secretary McNamara, it should be no larger than [redacted] technical people depending on the impact of other programs, but may utilize covert support capabilities elsewhere in DD/S&T to accomplish its assigned mission.

5. DD/S&T Organization - I have created a Special Projects Group within DD/S&T to handle all new CIA satellite reconnaissance programs. This group reports directly to me and is headed by Mr. J. D. Maxey. His group now consists of [redacted] CIA staff technical professionals and [redacted] support people, most of whom have been previously involved but are now being brought together in one unit. In addition, we have [redacted] technical professionals now in our recruiting pipeline who will be assigned to this group. However, only [redacted] technical people are focused on the FULCRUM project per se, so that we are well within the Director's guidelines to hold down the in-house personnel build up. If anything, we are somewhat light compared with comparable activities, and we will probably eventually grow to fill the [redacted] authorization mentioned by the Director to the PFIAB. Covert support will be provided by the Office of Special Activities, for the time being, and Mr. John McMahon has been assigned to the Special Projects Group to ensure that contracts, security, and communications support are adequate to the need.

6. The Special Projects Group will be responsible for the prosecution of the Phase I FULCRUM program, subject to my guidance and supervision. They will act as the single point of contact within the Government for the FULCRUM

contractors. They will exercise command, control, and supervision over the entire program and, with me, will be responsible for the decisions and actions that only the Government can take. This group will prepare all progress reports for the NRO and yourself. It will be responsible for the preparation of contractor work statements, evaluation of proposals and funded efforts, and the final presentation of the integrated FULCRUM system concept. In this role, they will be heavily supported so far as is proper by the systems engineering contractor (see below) who will report directly to them.

7. The Special Projects Group will be expected to examine the technical progress and financial expenditures of each contractor at least once per month so as to ensure that the program promptly and decisively settles the fundamental questions relating to the FULCRUM feasibility. This group will be responsible for approving all contracts and authorizing the release of funds and payment for satisfactory work. It will approve the need-to-know for security access within the contractor structure and will recommend, for my approval, FULCRUM clearances for other portions of Government. It will also be responsible for establishing appropriate contact with the Space Systems Division of the Air Force Systems Command, who are presumably the logical supplier for booster and launch facility information relevant to the basic system design and feasibility demonstration.

8. Contracts and Schedules - General - The Phase I FULCRUM program will last approximately six months and could begin on a broad front on the first of September. This program is designed to provide in February 1965 all analysis and the working demonstrations needed to establish the feasibility of FULCRUM and support a decision to proceed with its development. However, no contractor will be given any basis for assuming that a Phase II program is authorized or should be expected: all work statements for Phase I will carry an explicit warning to this effect. On the other hand, if it becomes clear as the program progresses that it either is or is not likely to carry forward, authorization will be sought from the Director and Mr. Vance to so advise the contractors so that they will not dissolve prematurely or continue unnecessarily the unusually well qualified design teams who will be engaged in Phase I. A detailed funding and scheduling breakdown is attached.

9. The contractual structure is divided into the components discussed in the Director's guidelines:

- a. Camera design.
- b. Film handling.
- c. Spacecraft.
- d. Re-entry vehicle.
- e. Systems engineering.

The substance of the effort to be conducted under each component and their general terms of reference is outlined below, together with the proposed contractors and the anticipated funding level.

10. Camera Design - ITEK has already been given a contract to establish the basic feasibility of the FULCRUM camera design, which is now partially funded from a share of the [redacted] provided by the Director (the rest of this sum went to start the film handling work at ITEK). The camera system work has several separate tasks, all of which will run for the entire six months of Phase I.

a. Optical Design	ITEK	[redacted]
b. Camera Dynamics	"	
c. Test Facility Design	"	
d. Camera Design	"	
e. Program Analysis	"	

We are also sponsoring a small [redacted] backup study at Perkin-Elmer to explore alternate optical/camera designs so that we will be sure that the eventual ITEK solution represents a true optimum. The total cost of the Phase I camera studies is therefore expected to be approximately [redacted].

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11. Film Handling - We propose to sponsor two competitive design efforts whose purpose will be to demonstrate that seven inch film can be handled as rapidly and accurately as required by the FULCRUM camera. One of these efforts is now begun at ITEK and partially funded toward an expected total cost of [redacted]. A second source with previously demonstrated capabilities in this field is STL and we propose to negotiate a parallel contract with them for [redacted] as soon as possible. Both efforts will attempt to produce an engineering prototype of the film drive, both of which are to be compatible with the camera design and either of which could be used. The total cost to the Government of this effort is estimated to be [redacted].

12. Spacecraft - We will conduct a funded competition lasting six weeks in order to provide an objective basis for selecting a spacecraft contractor to conduct preliminary design studies during Phase I and to ultimately build the spacecraft if FULCRUM becomes an approved Phase II program. Three contractors have demonstrated a genuine capability to design reliable spacecraft: Lockheed in CORONA/ARGON/LANYARD; General Electric in GAMBIT; and Space Technology Laboratories in Vela Hotel among others. Our plan is to give each of the three companies a funded proposal contract for [redacted] on 1 September. The detailed work statements and contractual letters are now prepared and ready for release. The results of these efforts will be evaluated during the last two weeks of October and a winner selected. By 1 November the winner will be awarded a [redacted] design study contract for the remaining three months of Phase I, working then as part of the FULCRUM team with DD/S&T and the systems engineering contractor. The total cost of the spacecraft design study would then be [redacted].

13. Re-entry Vehicle - A similar funded competition will be conducted between the two principal designers and manufacturers of re-entry vehicles: General Electric and Avco. Each will be given a six weeks, [redacted] study proposal contract early in September, the work statements for which are now being drafted. After the results have been evaluated, the winner will be funded to the extent of [redacted] for continuing design studies as part of the FULCRUM team. Total cost to the Government is [redacted].

14. Systems Engineering - We are anxious to establish a systems engineering contract as soon as possible so as to

assure maximum effectiveness throughout the entire program. This contractor would be responsible for providing general systems engineering and technical management support to the Special Projects Group of DD/S&T. Specifically, he would be responsible for the budgets governing weight, dynamic balance, electrical power, and expendables (i.e., gas). He would also provide interface control between the contractors and establish a quality and reliability engineering program. He will conduct analysis to determine what test, assembly and checkout facilities will be required if the program proceeds into Phase II. He will also be responsible for generating and/or checking detailed launch vehicle performance criteria (payload, guidance accuracy, etc.) which in turn will be furnished to the Air Force. Should the program proceed into Phase II, the role of this contractor would broaden to include actual assembly and checkout of the various payloads as they arrive at the launch site from the contractors. The SE contractor will have full and continuing access to all phases of the FULCRUM efforts in the component contractor facilities.

15. We have estimated that this central systems engineering effort should consist of a full time effort by approximately [redacted] technically qualified people. With adequate computer/simulation support, this amounts to approximately [redacted] for the five month period between 1 September 1964 and the end of Phase I. We have examined the firms suitable for this role and feel that STL is almost uniquely well qualified. STL has by a wide margin the most systems engineering experience, dating back to the beginning of the ballistic missile program in 1954. They have already demonstrated an ability to function in a supporting technical management role to the Government. We therefore propose to utilize the Director's provision for sole source in this crucial area and proceed as soon as possible to establish such a contract. This effort for [redacted] plus the costs listed above integrate up to [redacted] which is requested in addition to the [redacted] already provided.

16. Conclusion - Approval of the above terms of reference and program plan is requested.

ALBERT D. WHEELON
Deputy Director
for
Science and Technology

Approved: Mr. McCone has read and approved.

~~Marshall S. Carter~~
DDCI

date: 1 Sept 1964